Predation by a Jacky Lizard *Amphibolurus muricatus* (Agamidae) upon nesting Banded Bees *Amegilla* sp. (Apidae)

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Abstract
This paper reports observations of a single Jacky Lizard *Amphibolurus muricatus* (Agamidae) preying upon Banded Bees *Amegilla* sp. (Apidae) as they flew near their nesting aggregation in bushland of northern Sydney, NSW, Australia. The foraging behaviour of this wild *A. muricatus* individual may have been somewhat more complex than that previously reported for captive individuals of this species. Bees may constitute only a minor proportion of the diet of *A. muricatus* in the wild and lizards may be less effective predators upon nesting bees than birds. (*The Victorian Naturalist* **128** (2), 2011, 86–89)

Keywords: lizard, predation, bees, nest, aggregation

Introduction

Bees are preyed upon by a variety of vertebrates, including birds, lizards and toads, as well as invertebrates such as spiders, hunting wasps, robber flies and assassin bugs (O'Toole and Raw 1991). Invertebrate parasites associated with the nests of *Amegilla pulchra*, in the Brisbane area, were documented by Cardale (1968b). In Africa nesting honeybees *Apis mellifera* are sometimes preyed upon by lizards (Hepburn and Radloff 1998). Some arboreal geckos and skinks may feed on Asian honeybees returning to their nests (Oldroyd and Wongsiri 2006). Alcock (1996) reported intensive predation by birds on a species of *Amegilla* nesting in Western Australia.

Australian bees of the genus *Amegilla* (Apidae) are solitary in the activities that are involved in the rearing of their young, but frequently dig their nests in close proximity to each other, often forming nesting aggregations (e.g. Michener 1960; Cardale 1968a; Houston 1991; Cardale 1993; Dollin *et al.* 2000).

The Jacky Lizard *Amphibolurus muricatus* (Agamidae) (Fig. 1) occurs in south-eastern Australia, along the coast and ranges, inhabiting dry sclerophyll forests and coastal heathlands, where its diet consists of insects and other small arthropods (Cogger 2000). Warner (2007) stated that *A. muricatus* is a common species and can frequently attain high local densities. However, *A. muricatus* may have become much less common in the Lane Cove River area (where the observations in this paper were made) than it was in earlier years (Martyn 1994).

Generally, there appears to be a lack of dietary data for many lizard species (Pianka and Vitt 2003, p. 42). The majority of published dietary studies would appear to focus on analysing the stomach contents of lizards, with apparently fewer direct observations made of the predatory behaviour of lizards in the wild.

This paper describes observations of predation by *A. muricatus* (Fig. 1) on *Amegilla* sp. bees (Fig. 2) flying near their nesting aggregation (Fig. 3) in bushland in suburban northern Sydney. These observations are discussed in relation to the work of Hoese *et al.* (2008) describing predatory behaviour by *A. muricatus* in captivity.

Neither the lizard, nor any of the bees, were captured. The lizard was identified by consulting Cogger (2000), Wilson and Swan (2008),

Fig. 1. The Jacky Lizard waiting for a bee to fly nearby.

Fig. 2. *Amegilla* sp. flying near the nesting aggregation.

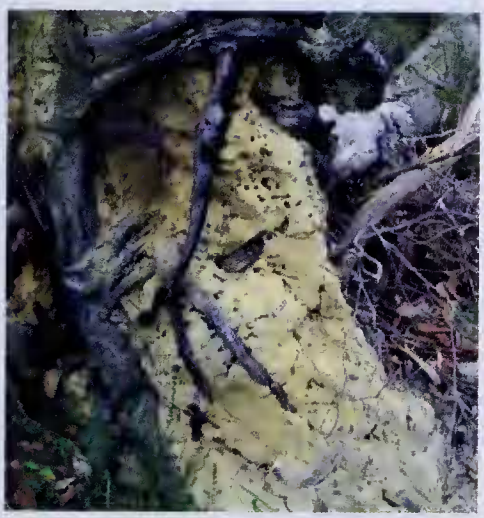

Fig. 3. The nesting aggregation of *Amegilla* bees.

Swan *et al.* (2004) and Griffiths (2006). The bee was identified to genus level by consulting Dollin *et al.* (2000).

Observations

The site of the *Amegilla* sp. nesting aggregation was in bushland of the Lane Cove River area, in suburban northern Sydney, NSW, Australia. The surrounding vegetation was sclerophyllous open-forest, with a somewhat sparse canopy and a shrubby and diverse understorey, growing in fairly shallow soil on a sandstone substrate. The site was located on a moderately sloping, north-facing hillside and was burnt by a wildfire approximately seven years before these observations. The bees were nesting in the soil around the roots of the upturned base of a fallen (but still living) *Eucalyptus* tree (Fig. 3). The dry, hardened soil around the upturned tree roots provided a more or less vertical surface for the bees to burrow into. Most of the *Amegilla* nesting burrows were located approximately 35-80 cm above the level of the surrounding ground, with a few a little lower. There were a few dozen individual burrows in the nesting aggregation, but some of them may not have been occupied by bees at the time of the observations.

The *Amphibolurus muricatus* was observed preying on the bees in the late afternoon on a day in mid-November, 2009, approximately two hours before sunset. The day had been warm and dry, with some high cloud in the late afternoon and evening.

The lizard positioned itself on the sloping compacted soil base of the *Amegilla* nesting aggregation, approximately 15-20 cm above the surrounding ground level (Fig. 1). When an *Amegilla* bee flew near the lizard, the *A. muricatus* watched intently, tracking the bee's movements with adjustments of its own head and/or body. The bees were flying quite rapidly (e.g. Fig. 2) and often rather erratically. On several occasions, the lizard lunged quickly, with its mouth open and tongue protruding, at an *Amegilla* bee that was flying nearby. The lizard caught one flying *Amegilla* bee in its mouth, but also missed other targeted bees a number of times. Each lunge was separated by a period of watching and waiting, until another bee came close enough for the *A. muricatus* to strike. On one occasion, the lizard slightly and rapidly flicked out its tongue three times and also slightly opened its mouth two more times, whilst rapidly moving its head, slightly moving its eye and making slight adjustments of its body, as it intently watched an *Amegilla* bee weaving and darting through the air, a few centimetres in front of the lizard. On this occasion the *A. muricatus* did not attempt to lunge at the bee, possibly because the *Amegilla* was flying too erratically and rapidly.

The *A. muricatus* engaged in predatory behaviour for approximately ten minutes and then moved about one metre away from the nesting site, where it rested on the ground amongst the leaf litter for about one hour, before disappearing from sight.

Discussion

Generally, lizards in the family Agamidae are 'sit-and-wait' predators, i.e. they position themselves quietly in one spot, watching for prey which they then pursue (Greer 1989; Pianka and Vitt 2003). Most agamids tend to feed on mobile prey, which they detect visually, and tend to have a relatively low daily energy intake (Pianka and Vitt 2003). The prey of *A. muricatus* needs to be moving in order for this lizard to detect it (Hoese *et al.* 2008).

Hoese *et al.* (2008) studied the feeding behaviour of *A. muricatus* in captivity. They fed crickets to 20 mature male Jacky Lizards that had been captured and removed from bushland south of Sydney. They noted that each feeding session typically began with the lizard perched and scanning its enclosure. When the cricket was introduced into the enclosure, the *A. muricatus* oriented its head or an eye towards the movement of the prey item. Then the lizard moved towards the cricket, struck with its mouth open and finally consumed the prey. Occasionally, one of the captive lizards would strike at the cricket and miss, or move towards the cricket, only to lose sight of it in the foliage. Generally, the prey-capture sequence described by Hoese *et al.* (2008) is similar to the behaviour observed in this present study of an *A. muricatus* preying on bees in the wild. One difference is that the bees were flying rapidly, whereas the crickets in the study of Hoese *et al.* (2008) were presumably mostly crawling when preyed upon by the lizards. The *A. muricatus* in this present study had to locate the bees' nesting site and then position itself in a spot at which some of the bees were occasionally flying at an accessible height, where the lizard then waited until a bee flew close enough for it to strike. The willingness of the lizard to launch a strike was probably influenced by the degree to which the bee was flying erratically, as well as by how close the bee was to the lizard. This required the *A. muricatus* to keep track of the darting and weaving flight paths of the bees and then judge the right time to strike. The foraging behaviour of this individual may have been somewhat more complex than that described by Hoese *et al.* (2008) for captive *A. muricatus* preying on crickets.

Bees are likely to be a minor component of the diet of a lizard species such as *A. muricatus*. Pianka and Vitt (2003) analysed the diets of 83 neotropical and 92 desert species of lizard. They found that non-ant hymenopterans contributed only a small percentage of the diet (by volume) of the species studied, including iguanians. However, the iguanian lizards (including Agamidae) consumed more ants and other hymenopterans than did the scleroglossans (including such lizard families as the Scincidae). Pianka and Vitt (2003) suggested that this difference may be due to the visually reliant iguanians being less readily repelled by any noxious chemicals that might be produced by various hymenopterans. Hepburn and Radloff (1998) indicated that lizards are probably mostly minor, opportunistic predators of honeybees *Apis mellifera* in Africa, but that special guards may need to be deployed for hives in Ghana, to protect them from lizards. Heideman (2002) studied the stomach and intestinal contents of *Agama aculeata* and *A. planiceps* (Agamidae) in a cool steppe region of Namibia, in south-western Africa, and found that both species had fed quite frequently on honeybees. Huang (2007) recorded the stomach contents of twenty individuals of the lizard *Japalura swinhonis* (Agamidae) captured on Orchid Island, situated off the south-eastern (tropical) coast of Taiwan. He found that the stomach of one lizard contained a bee (Apidae), but that ants and crickets were the most frequent items of prey found in the sampled individuals of this species at that location.

The *Amegilla* bees may not have been aware of the presence of the *A. muricatus* whilst it remained still, waiting for them to fly near. However, the bees may have taken some evasive action, possibly altering their flight paths, immediately after the lizard had lunged at them, on those occasions when the lizard missed the bees. It seems likely, given its camouflage, that the *A. muricatus* was not visible to the bees, as long as it remained motionless. Houston (1991) noted that when a corvid (raven or crow) glided over a large nesting aggregation of Dawson's Burrowing Bees *Amegilla dawsoni* in Western Australia, it was immediately pursued out of the area by the bees. He also stated that the bees would soon swarm around, without attacking, a newly arrived human observer at an active

nesting site, but the *A. dawsoni* bees eventually lost interest if the observer remained still.

Birds may be more effective predators upon nesting bees than are lizards. Alcock (1996) observed Pied Butcherbirds *Cracticus nigrogularis* preying upon *Amegilla dawsoni* at two nesting/emergence sites in Western Australia, with at least ten birds killing 145 bees. At one of these sites he saw seven *C. nigrogularis* make 230 attacks on the bees over a 7.5 hour period. *A. dawsoni* is a very large and robust bee (Houston 1991) and is larger than the species of *Amegilla* bee studied in this present paper. A lizard species, such as *A. muricatus*, lacking the obvious advantages possessed by a flying predator, may not be capable of preying so intensively upon bees.

More remains to be learnt about the diet of *A. muricatus* in the wild and the extent of lizard predation upon nesting bees in Australia.

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